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(54) Method of heating glass sheet for laminated glass

Verfahren zum Erhitzen einer Glasscheibe für laminiertes Glas

Procédé de chauffage d'une feuille de verre pour verre laminé

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Description

The present invention relates to a sheet glass heating method, and more particularly to a method of heating a glass sheet for laminated glass.

Laminated glass, which finds wide use as front windshields of automobiles, is manufactured by heating first and second glass sheets to be paired in a heating furnace, shaping and annealing the glass sheets, and then joining the glass sheets face to face. The glass sheets may be shaped by a press shaping process, a gravity shaping process, or a roller shaping process. The first and second glass sheets are joined face to face by adhesive bonding with an intermediate film as of polyvinyl butyral sandwiched therebetween.

When the first and second glass sheets are to be bonded to each other, it is necessary that they be of a bent configuration having substantially the same shape. Basically, the first and second glass sheets are heated under the same conditions in the heating furnace so that they are held at the same temperature To at the exit of the heating furnace. The first and second glass sheets are fed, alternately one by one, two by two, or three by three, into the heating furnace.

The first and second glass sheets, from which laminated glass is to be constructed, may not necessarily have the same characteristics, such as thickness, material properties, and coloured conditions, at all times. For example, the first and second glass sheets may have different thicknesses, or the first glass sheet may be a coloured transparent glass sheet whereas the second glass sheet may be a colourless transparent glass sheet. If the first and second glass sheets have such different characteristics, then they tend to be held at different temperatures To at the exit of the heating furnace. As a result, the first and second glass sheets may not be shaped desirably, and may not appropriately be bonded to each other after they are shaped and annealed.

The present invention has been made in an effort to effectively solve the aforesaid problems of the conventional method of heating glass sheets for laminated glass.

It is an object of the present invention to provide a method of heating first and second glass sheets for laminated glass so that even if the first and second glass sheets have different characteristics, they can be held at the same temperature To at the exit of a heating furnace, can be shaped to desired configuration and can well be bonded face to face to each other after they are shaped and annealed.

According to the invention, there is provided a method of heating a first glass sheet and a second glass sheet which are to be combined into a single laminated glass sheet, in a heating furnace before the first and second glass sheets are shaped, the first glass sheet being heatable more easily than the second glass sheet, said method being characterised by the step of preheating the second glass sheet before introducing it into the heating furnace.

The above and further objects, details and advantages of the present invention will become apparent from the following detailed description of preferred embodiments thereof, when read in conjunction with the accompanying drawings.

FIG. 1 is a schematic plan view of a sheet glass bending apparatus which carries out a method of heating glass sheets for laminated glass according to the present invention;

FIG. 2 is a fragmentary longitudinal cross-sectional view of an upstream portion of the sheet glass bending apparatus shown in FIG. 1;

FIGS. 3A through 3C are views showing various sequences by which first and second glass sheets are heated;

FIGS. 4 and 5 are perspective views of heaters for use in a preheating zone in the sheet glass bending apparatus shown in FIG. 1; and

FIG. 6 is a graph showing the relationship between heating times and temperatures at the exit of a heating furnace when various glass sheets are heated in the heating furnace which is kept at a constant temperature therein.

FIG. 6 shows the relationship between heating times and glass temperatures at the exit of a heating furnace when four kinds of sheet glass are heated in the heating furnace which is kept at a constant temperature Ti therein. All the four glass sheets are sized 450 mm x 450 mm. The horizontal axis of the graph of FIG. 6 represents a heating time t and the vertical axis represents the glass temperature To at the exit of the heating furnace. The characteristics of the heated glass sheets are indicated by respective curves X1, X2, Y1, Y2.

In the experiment to obtain the data shown in FIG. 6, the heating furnace had ceramic rollers for feeding glass sheets and electric heaters inside of the furnace wall. The surface temperature of each of the heaters was controlled so as to be at a desired level by a thermocouple. Specifically, the surface temperature of the heaters above the rollers was kept at 660° C, and the surface temperature of the heaters below the rollers was kept at 650° C.

	Thickness	Colour
X1:	2.0 mm	Blue (= coloured transparent glass)
X2:	2.3 mm	Blue (= coloured transparent glass)
Y1:	2.0 mm	Colourless (= colourless transparent glass)
Y2:	2.3 mm	Colourless (= colourless transparent glass)

It can be understood from FIG. 6 that when the glass sheets are heated under the same conditions, the temperatures To of the coloured glass sheets at the exit of the heating furnace are generally higher than the temperatures To of the colourless glass sheets at the exit of the heating furnace. Comparison between the coloured glass sheets or the colourless glass sheets indicates that the glass temperature To at the heating furnace exit is higher as the glass sheet thickness is smaller.

If the shape, material property, or colour of a first glass sheet for laminated glass is different from the shape, material property, or colour of a second glass sheet, when the first and second glass sheets are heated under the same conditions, their temperatures To at the exit of the heating furnace are different from each other.

FIGS. 1 and 2 schematically show a sheet glass bending apparatus, generally designated by the reference numeral 300, which carries out a method of heating glass sheets for laminated glass according to the present invention. It is assumed that a single laminated glass sheet is constructed of first and second glass sheets G1, G2 and the first glass sheet G1 can be heated more easily than the second glass sheet G2.

The sheet glass bending apparatus 300 comprises a heating furnace 301 which is heated to a constant temperature Ti therein, a preheating zone 307 positioned upstream of the heating furnace 301, an intermediate zone 308, disposed between the heating furnace 301 and the preheating zone 307, and a press machine 302, a lehr 303 and a pickup device 304 which are successively disposed downstream of the heating furnace 301. A succession of first rollers 305 (FIG. 2), serving as a feed conveyor, is disposed in an upstream region. A succession of second rollers 306, also serving as a conveyor, are disposed in the preheating zone 307, the intermediate zone 308, and the heating furnace 301, the second rollers 306 being arrayed over the entire length of the heating furnace 301. The preheating zone 307 has line burners 309 (see FIG. 4) disposed above and below a glass sheet feed path, for heating the upper and lower surfaces of second glass sheets G2. The preheating zone 307 may have a panel heater 310 (see FIG. 5) instead of the line burners 309. The intermediate zone 308 may be part of the heating furnace 301.

A first glass sheet G1 is introduced through the intermediate zone 308 into the heating furnace 301.

A second glass sheet G2 is first introduced into the preheating zone 307 in which the upper and lower surfaces of the second glass sheet G2 are uniformly heated by the burners 309 until the glass sheet G2 reaches a predetermined temperature in its entirety. The new intensities of heat applied to the upper and lower surfaces of the glass sheet G2 are thus so equalized that the glass sheet G2 is prevented from warping when it is preheated. Thereafter, the second glass sheet G2 is introduced into the heating furnace 301.

After the two glass sheets G1, G2 have been introduced into the heating furnace 301, they are fed over the entire length of the heating furnace 301 at a constant speed V by the second rollers 306. The second glass sheet G2 is introduced into the heating furnace 301, following the first glass sheet G1.

Therefore, the first and second glass sheets G1, G2 are introduced into the heating furnace 301 such that the glass sheets G1, G2 to be paired into a laminated glass sheet are disposed closely to each other. When the glass sheets G1, G2 are heated in the manner described above, they are alternately introduced into the heating furnace 301 as shown in FIG. 3A, and successive first and second glass sheets G1, G2 are combined into laminated glass sheets.

As shown in FIG. 3B, sets of two first glass sheets G1 and sets of two second glass sheets G2 may alternately be introduced into the heating furnace 301, and successive two glasses G1, G2 or successive two glasses G2, G1 may be combined into laminated glass sheets.

Alternatively, as shown in FIG. 3C, sets of three first glass sheets G1 and sets of three second glass sheets G2 may alternately be introduced into the heating furnace 301, and each of the first glass sheets G1 in one set may be combined with the third following second glass sheet G2 in the next set, thereby making up a laminated glass sheet.

When the glass sheets G1, G2 are thus heated, the temperature To1 of the first glass sheet G1 at the exit of the heating furnace and the temperature To2 of the second glass sheet G2 at the heating furnace exit are equalized to each other. More specifically, in the sheet glass bending apparatus 300, the distances over, and the average speeds at, which the first and second glass sheets G1, G2 are fed in the heating furnace 301, are equal to each other. However, the temperatures To1, To2 are equalized to each other since the second glass sheet G2 is preheated before it is introduced into the heating furnace 301.

The degree to which the second glass sheet G2 is preheated in the preheating zone 307 is determined depending on the temperature Ti in the heating furnace 301 and desired temperatures To1, To2 of the glass sheets G1, G2 at the exit of the heating furnace 301.

With the heating methods according to the present invention, as described above, the temperatures To1, To2, at the exit of the heating furnace, of first and second glass sheets G1, G2 which are to be combined into a laminated glass sheet and which have different characteristics are equalized to each other. Therefore, the glass sheets G1, G2 can be pressed or otherwise processed into a desired shape. As a consequence, the glass sheets G1, G2 can well be bonded to each other after they have been shaped and annealed.

In the illustrated embodiment, it is necessary that the temperatures To1, To2 of the first and second glass sheets G1, G2 at the exit of the heating furnace be equal to each other. However, this requirement may not be satisfied if the glass sheets G1, G2 should be heated to different temperatures To1, To2 at the exit of the heating furnace depending on the condition in which the glass sheets G1, G2 will subsequently be bent to shape.

Although there have been described what are at present considered to be the preferred embodiment of the present invention, it will be understood that the invention may be embodied in other specific forms without departing from the scope of the claims.

Claims

1. A method of heating a first glass sheet (G1) and a second glass sheet (G2) which are to be combined into a single laminated glass sheet, in a heating furnace (301) before the first and second glass sheets (G1, G2) are shaped, the first glass sheet (G1) being heatable more easily than the second glass sheet (G2), said method being characterised by the step of:

   preheating the second glass sheet (G2) before introducing it into the heating furnace.

2. A method of heating a first glass sheet (G1) and a second glass sheet (G2) as claimed in claim 1, characterised by:

   keeping the furnace (301) at a constant temperature; and feeding the first and second glass sheets (G1, G2) over the same distance in the heating furnace (301).

3. A method of heating a first glass sheet (G1) and a second glass sheet (G2) as claimed in claim 1 or 2, further characterised by equalising the intensities of heat applied to the upper and lower surfaces of the second glass sheet (G2) during preheating so that the second glass sheet is prevented from warping.

4. A method of heating a first glass sheet (G1) and a second glass sheet (G2) as claimed in claim 1, 2 or 3, characterised in that both glass sheets (G1, G2) are fed through the furnace (301) at the same speed.

5. A method of heating a first glass sheet (G1) and a second glass sheet (G2) as claimed in any preceding claim characterised in that both glass sheets (G1, G2) are fed over the entire length of the furnace (301).

6. A method of heating a first glass sheet (G1) and a second glass sheet (G2) as claimed in any preceeding claim characterised in that both glass sheets (G1, G2) have substantially the same temperature at the exit of the furnace (301).

Patentansprüche

1. Verfahren zum Heizen einer ersten Glaslage (G1) und einer zweiten Glaslage (G2), welche zu einer einzigen, laminierten Glaslage zu kombinieren sind, in einem Heizofen (301) bevor die erste und zweite Glaslage (G1, G2) geformt werden, wobei die erste Glaslage (G1) leichter aufheizbar ist als die zweite Glaslage (G2), und wobei das Verfahren gekennzeichnet ist durch den Schritt des Vorheizens der zweiten Glaslage (G2), bevor diese in den Heizofen eingeführt wird.

2. Verfahren zum Heizen einer ersten Glaslage (G1) und einer zweiten Glaslage (G2) nach Anspruch 1, gekennzeichnet durch das Halten des Ofens (301) auf einer konstanten Temperatur und das Weiterbewegen der ersten und zweiten Glaslage (G1, G2) über die gleiche Strecke im Heizofen (301).

3. Verfahren zum Heizen einer ersten Glaslage (G1) und einer zweiten Glaslage (G2) nach Anspruch 1 oder 2, ferner gekennzeichnet durch das Angleichen der Intensitäten der auf die obere und untere Fläche der zweiten Glaslage (G2) während des Vorheizens angewandten Wärme, so daß ein Verziehen der zweiten Glaslage verhindert wird.

4. Verfahren zum Heizen einer ersten Glaslage (G1) und einer zweiten Glaslage (G2) nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß beide Glaslagen (G1, G2) mit der gleichen Geschwindigkeit durch den Ofen (301) weiterbewegt werden.

5. Verfahren zum Heizen einer ersten Glaslage (G1) und einer zweiten Glaslage (G2) nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß beide Glaslagen (G1, G2) über die ganze Länge des Ofens (301) weiterbewegt werden.

6. Verfahren zum Heizen einer ersten Glaslage (G1) und einer zweiten Glaslage (G2) nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß beide Glaslagen (G1, G2) am Ausgang des Ofens (301) im wesentlichen die gleiche Temperatur aufweisen.

Revendications

1. Procédé de chauffage d'une première feuille de verre (G1) et d'une seconde feuille de verre (G2) devant être combinées en une seule feuille de verre stratifiée, dans un four à chauffer (301) avant la mise en forme des première et seconde feuilles de verre (G1, G2), la première feuille de verre (G1) pouvant être chauffée plus facilement que la seconde feuille de verre (G2), ledit procédé étant caractérisé par l'étape consistant :

   à préchauffer la seconde feuille de verre (G2) avant de l'introduire dans le four à chauffer.

2. Procédé de chauffage d'une première feuille de verre (G1) et d'une seconde feuille de verre (G2) selon la revendication 1, caractérisé par :

   le maintien du four (301) à une température constante ; et l'amenée des première et seconde feuilles de verre (G1, G2) sur la même distance dans le four à chauffer (301).

3. Procédé de chauffage d'une première feuille de verre (G1) et d'une seconde feuille de verre (G2) selon la revendication 1 ou 2, caractérisé en outre par l'égalisation des intensités de chaleur appliquées aux surfaces supérieure et inférieure de la seconde feuille de verre (G2) au cours du préchauffage de manière à empêcher le gauchissement de la seconde feuille de verre.

4. Procédé de chauffage d'une première feuille de verre (G1) et d'une seconde feuille de verre (G2) selon la revendication 1, 2 ou 3, caractérisé en ce que les deux feuilles de verre (G1, G2) sont amenées à travers le four (301) à la même vitesse.

5. Procédé de chauffage d'une première feuille de verre (G1) et d'une seconde feuille de verre (G2) selon l'une quelconque des revendications précédentes, caractérisé en ce que les deux feuilles de verre (G1, G2) sont amenées sur toute la longueur du four (301).

6. Procédé de chauffage d'une première feuille de verre (G1) et d'une seconde feuille de verre (G2) selon l'une quelconque des revendications précédentes, caractérisé en ce que les deux feuilles de verre (G1, G2) ont sensiblement la même température à la sortie du four (301).

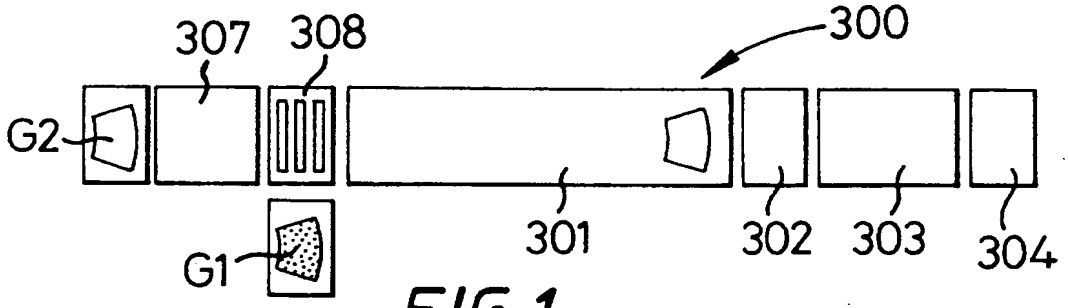

FIG. 1

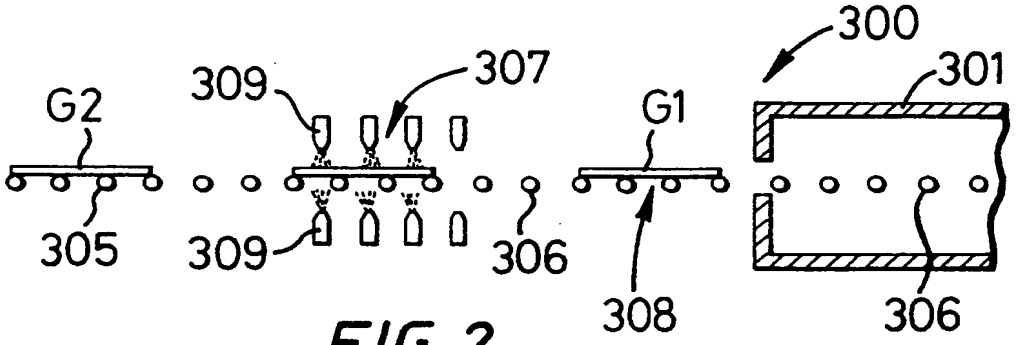

FIG. 2

FIG. 3A

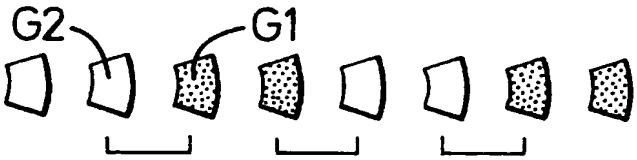

FIG. 3B

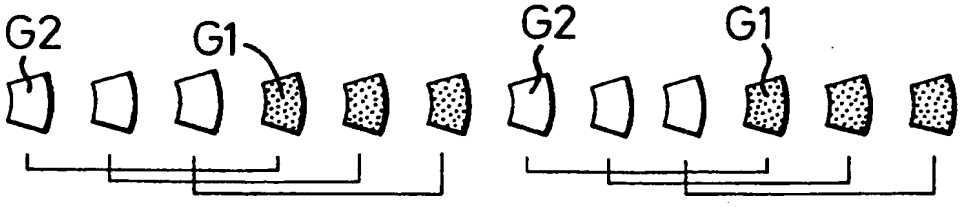

FIG. 3C

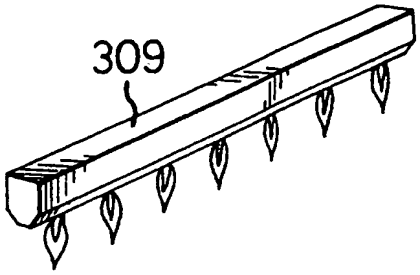

FIG. 4

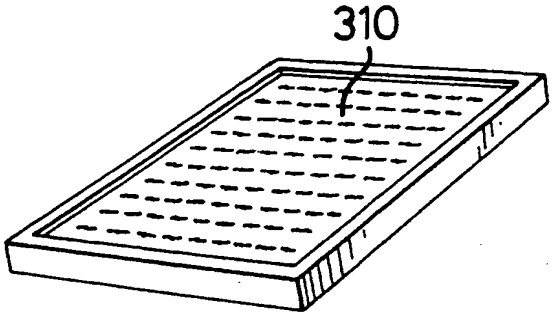

FIG. 5

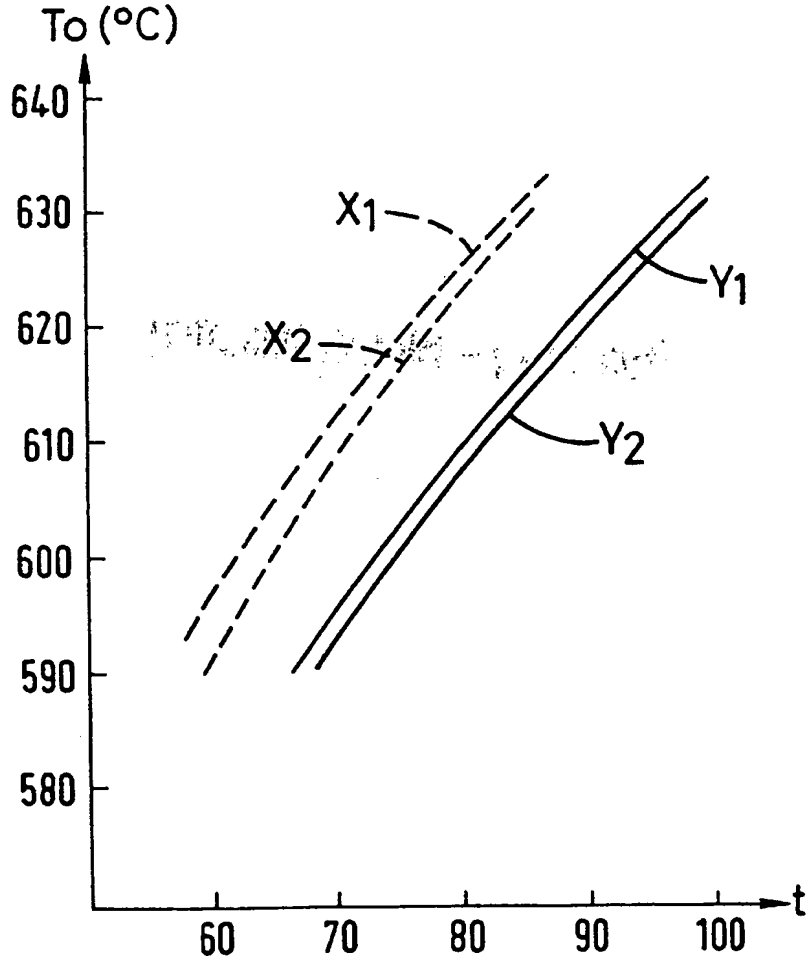

FIG. 6